

**RATE OF SOIL DEVELOPMENT AS INDICATED
BY PROFILE STUDIES OF INDIAN MOUNDS**

**BY
LIEN-CHIEH LI**

**B.S., Yenching University, 1932
M.S., University of Tennessee, 1941**

AN ABSTRACT OF A THESIS

**SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN
AGRONOMY IN THE GRADUATE SCHOOL OF THE
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**URBANA, ILLINOIS
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RATE OF SOIL DEVELOPMENT AS INDICATED BY PROFILE STUDIES OF INDIAN MOUNDS

Soils possess different properties. The measurement of soil properties indicates the stages of soil development and the level of soil fertility. When the age of a soil is known, the expression of its properties on a per unit time basis will give the rates of the development of its properties. The importance of these rates of development is twofold: on the one hand, they indicate the genetic character of a soil; on the other, they furnish quantitative information concerning the management of soil fertility problems of our agricultural lands. It was the purpose of this investigation to obtain information regarding the rate of development from the study of the soils formed in Indian mounds, whose age archaeologists estimated to be 1800 years. These particular mounds are located in Fulton County, central Illinois. It is hoped that the results of this study will throw light on the solution of some of the local pedological and agricultural problems in addition to obtaining a pedological means of determining the age of the mounds.

The local environmental conditions such as climate, vegetation, topography and drainage were all considered. They were found to have been reasonably constant during the development of these soils in the past 1800 years.

The parent material of the mound soils was calcareous Peorian loess. Two representative profile samples were studied. They were subjected to mechanical analysis, pH determination, base-exchange capacity studies and other analyses on total and inorganic carbon, nitrogen, and replaceable potassium. The organic matter was estimated from the difference between the total carbon and inorganic carbon values.

Mechanical composition of these soils showed that no ap-

preciable elluviation or illuviation has taken place. The only mechanical development shown was within the colloidal fractions in which an increase of more than 4 percent of $<.2$ Mu fractions over the parent material was evident. This increase was, however, found to be due to surface weathering and addition of organic colloid.

The reaction profiles indicated that these were still saturated soils.

The differences in the carbonate content of the profiles studied are attributed to leaching. The leaching of the excess of carbonates was found to be a major soil weathering process which has resulted in a relative increase in percentages of other minerals. This was illustrated by the indirect relations between the quantity of the replaceable potassium and the calcium carbonate present in the different horizons of the profiles.

The average rates of leaching of carbonates were found to be 50.4 pounds per acre inch per year of the first inch of surface soil and 27.0 pounds per acre inch per year of the entire solum. Based on these rates, it was estimated that it would take approximately 350-400 years for the completion of the leaching of the carbonates from the first inch of the surface soil and a much longer time would be required, at least 2000 years, for a complete removal of the carbonates from the entire solum.

The large amount of organic matter in the surface horizon was found to have close relationship to the excess of calcium carbonate in the profiles. It is believed that the Ca ions bound the organic acids and impeded their decomposition resulting in an accumulation of a neutral humus. The presence of this humus was found to be responsible for the increase of colloid, for the high base-exchange capacity, and for the high fertility level of the soil in general.

The average rate of accumulation of organic matter was found to be 14.0 pounds per acre inch per year for the first inch of surface soil, while the average rate for the entire pro-

file was 3.8 pounds per acre inch per year.

The accumulation of organic matter in these youthful forest soils under the present environmental conditions is believed to have at least the same order of magnitude as that of the prairie soils.

The fertility level of these soils was found to be largely controlled by the dual existence of the calcium carbonate and organic matter. It is believed that the level will eventually though very slowly be lowered by the continuous leaching of the carbonates from the soils. No rapid decrease of the organic matter will occur until the removal of carbonates is completed from the surface soil several centuries in the future.

Weathering, under local conditions, was found to have been very slow. It has been confined primarily to leaching of carbonates. These soils are far from being in equilibrium with their environment and their properties are under constant change as their age progresses. Therefore, it is concluded that since the leaching of carbonates under local conditions was slow, since the rate of leaching is relatively easy to measure, and since the time required for complete removal of carbonates from the 30 inches of the solum has been calculated to be approximately 4000 years, further studies on the other mounds in the vicinity will be very fruitful particularly in connection with the finding of a pedological means to determine the age of the Indian mounds.

VITA

The author was born July 4, 1908, in Yu-tien, Hopei, China. He attended Peking Academy, in Peiping and was graduated in the spring of 1927.

After travelling for a year, the author enrolled in the Yenching University in Peiping and received his degree of Bachelor of Science from that institution in the spring of 1932. He then joined the Soil Division of the National Geological Survey of China. Eight years were spent in studying the soils in different parts of China before he was given the chance to further his studies and observe agricultural practices abroad.

In August, 1940, the author arrived in the United States and enrolled in the Graduate school of the University of Tennessee. He was granted the degree of Master of Science from that institution in August, 1941. Since September, 1941, he has been enrolled in the Graduate School of the University of Illinois.

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